Stockton Lake Water Quality Summary
2006-2015

The US Army Corps of Engineers (USACE) Water Quality Program collects monthly water samples at Stockton Lake* from April through September. These figures present data collected between 2006-2015 from three lake sites (#7, #13, #25), four inflow sites (ST-43, ST-14, ST-10, ST-20) and the outflow (ST-2) below the dam. Thirty-four chemical, physical and biological parameters are measured to evaluate water quality. USACE use this data to describe conditions and changes from the inflows, lake, and outflow focusing on eutrophication, nutrients, sediment, herbicides, metals, and contaminants.

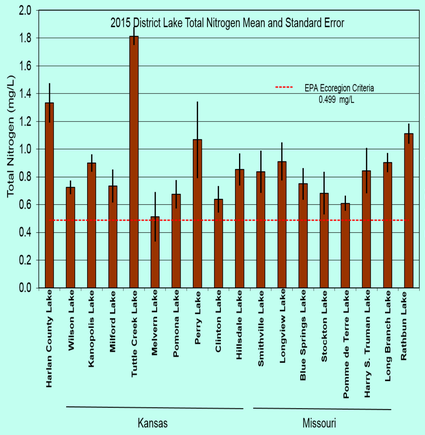
*Note: The term "lake" is substituted for technically correct "reservoir" throughout this document for consistency.

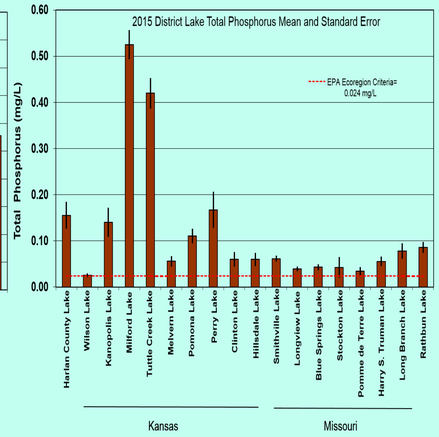
Stockton Lake

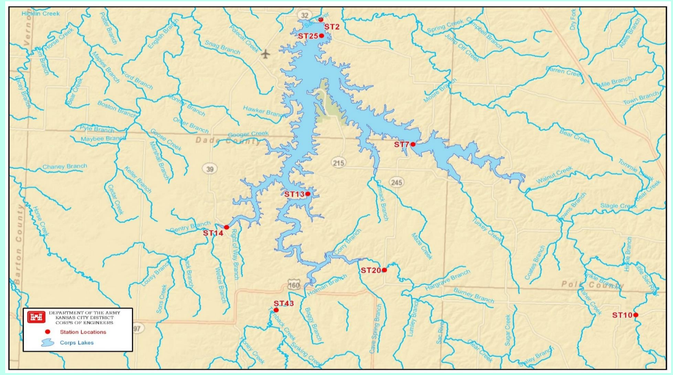
- Built on Sac River reaching full pool in 1971.
- **Watershed** = 1,160 square miles/ 742,400 Surface Acres (SA)
- **Capacity**:
  - Flood Control: 776,066 Acre-feet (AF) / 38,281 SA
  - Multipurpose: 874,887 AF / 24,632 SA / 298 miles of shoreline
  - Avg. annual inflow (2006-2015)= 892,559 AF; 2015 inflow= 1,459,749 AF
- **Operating project purposes**: flood control, hydroelectric power, water quality, recreation, fish and wildlife, and water supply.
- **Water Quality** in Stockton Lake in 2015 was beneficial to operating purposes listed above and did not exceed MO State WQ Standards for designated uses. Turnback Creek is on the MDNR impaired waters list due to e. coli bacteria impacts to swimming and wading since 2010, upstream of Stockton Lake and stream sample site (ST-43).

Nutrient Enrichment

Nutrients (i.e. phosphorus and nitrogen) are essential for aquatic life and are the primary factor influencing aquatic plant and fish growth rates and productivity. Excess nutrients from urban, agricultural or natural sources increases the natural aging or eutrophication process in lakes. This can alter plant and aquatic life in lakes and water bodies, cause algal blooms, create low dissolved oxygen affecting fish survival, and lead to taste and odor issues in drinking water. In 2015, Stockton Lake was below the District Lake average for total phosphorus (0.12 mg/L) and total nitrogen (0.88 mg/L) measured at the site nearest the dam. Average total phosphorus at the dam was above the EPA Ecoregion recommended criteria (0.024 mg/L) and at the low end of mesotrophic range of biological productivity. Mesotrophic lakes are characterized by moderate levels of nutrients and clear water (i.e. secchi measurement 2-4 meters) which provide good growing conditions for aquatic plants and algae which benefit the aquatic food chain including sportfish. Standard error bars in the graphs below illustrate the variation in nutrient sample results from each site in 2015.

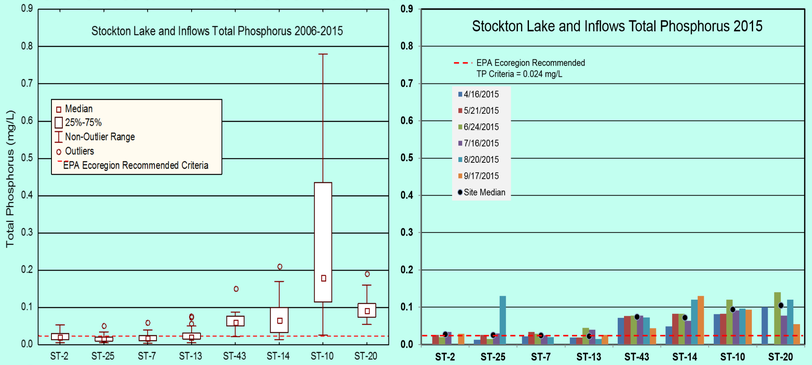






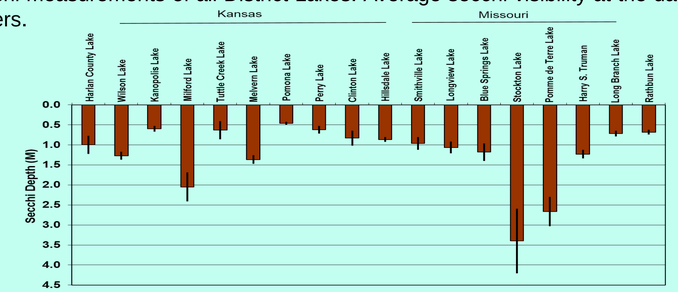
Total Phosphorus

Stockton Lake total phosphorus (TP) median concentrations during 2015 were similar to EPA Ecoregion recommended criteria (0.024 mg/L) at lake sites. Similar to most impoundments, higher TP concentrations and a wider range of data is usually found in the upper lake sites and inflows due to mobilized nutrients bound to silt particles in moving water in inflows and biological uptake or decline of TP and settling as the water moves through the lake to the dam. Total phosphorus samples collected in 2015 from Stockton Lake and the Sac River (ST-20) were similar 10-year data trends. Total phosphorus measured at inflow sites ST-43 and ST-14 exceeded the 75% quartile of 10-year data except in the September. Inflow from L. Sac River (ST-10) showed drastic reductions in phosphorus in 2015 despite 38% increase in stream flow. Median TP and all monthly TP measurements except June were less than 75% of all TP records from Little Sac River from 2006-2015.



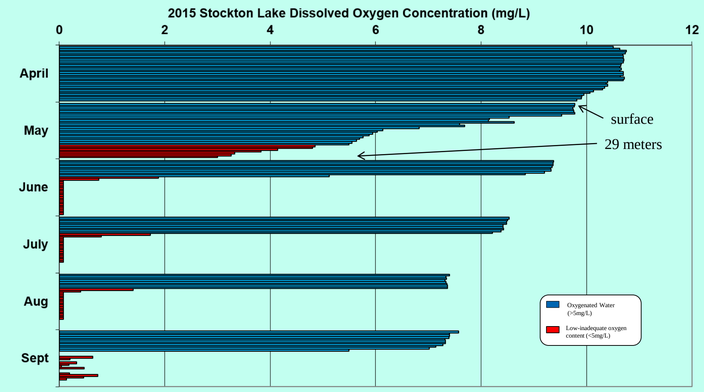
Secchi Depth

Secchi depth is a measure of water transparency or visibility in lakes. Organic (i.e. planktonic algae) and inorganic (i.e suspended sediment) turbidity reduces transparency. Total phosphorus and TSS are inversely related to transparency as seen in Stockton and all District Lakes. Lakes with the least nutrients and turbidity have high secchi measurements and sunlight penetration. In 2015, Stockton Lake had the deepest secchi measurements of all District Lakes. Average secchi visibility at the dam was 3.4 meters.



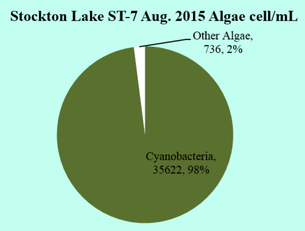
Dissolved Oxygen

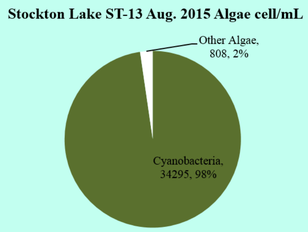
Dissolved oxygen (D.O.) is an important factor in aquatic species location, growth, and ultimately survival in lakes. Some lakes undergo a process called stratification or develop layers based on temperature and oxygen. This process begins in late spring, remains throughout the summer, and the layers mix (de-stratifies or 'turns over') in the fall. The figure below shows dissolved oxygen measured in the water column in one-meter intervals (e.g. each row in each month represents one meter of depth) from April through September at the dam (ST 25). Stockton Lake stratifies during the summer, however adequate (>5 mg/L) dissolved oxygen is typically available in the lake. In 2015, Stockton Lake was oxygenated in the top 7 meters during the worst conditions in August.



Algae

Algae and green plants are the base of the food chain in aquatic food webs and convert nutrients and CO_2 through photosynthesis into biomass for all aquatic life. Chlorophyll is a measure of the active green pigment present in beneficial algae and harmful blue-green algae (cyanobacteria) active in this process. Chlorophyll a is a critical measurement as it relates nutrients like phosphorus and nitrogen to biological productivity related to algae (good and bad), aquatic invertebrate production, and fish growth. Blue-green algae is occasionally present in all lakes. In 2015, Stockton algae samples in August illustrated that cyanobacteria populations dominated both lake arms, but cell counts were relatively low and composed of species not known to produce toxins.





Water Quality Concerns:

- Eutrophication
- Sediment inputs

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